



CALIFORNIA
ENERGY
COMMISSION

Semi-Annual Report Concerning The **Public Interest Energy Research Program**

November 1, 2002 through April 30, 2003
Report to the Governor and Legislature

COMMITTEE REPORT

June 2003
P500-03-046F



Gray Davis, Governor

June 12, 2003

Members of the Senate Energy, Utilities and Communications Committee
Members of the Senate Budget and Fiscal Review Committee
Members of the Senate Appropriations Committee
Members of the Assembly Utilities and Commerce Committee
Members of the Assembly Budget Committee
Members of the Assembly Appropriations Committee
California State Capitol Building
Sacramento, California 95814

**The California Energy Commission's Semi-Annual Report Concerning
The Public Interest Energy Research Program**

Dear Members:

In accordance with Public Resources Code Section 25620.5(h), the California Energy Commission hereby transmits its Semi-Annual Report regarding the Public Interest Energy Research (PIER) Program for the period November 1, 2002 through April 30, 2003. (The Legislative Analyst has requested that all PIER program semi-annual reports be submitted on or before June 1 and December 1 of each year.) The enclosed report provides the required evaluation of the progress and a status of the PIER Program's implementation for this reporting period.

The Energy Commission is continuing to make substantial progress in meeting the goals of the PIER Program, as demonstrated by the results of PIER-funded projects that will advance science and technology to improve the quality of life for California citizens. Should you have questions or comments concerning this report, please feel free to contact Cecile Martin, Assistant Director in the Energy Commission's Office of Governmental Affairs, at 654-4942.

Respectfully submitted,

ARTHUR H. ROSENFELD
Commissioner and Presiding Member
Research, Development and
Demonstration Committee

JOHN GEESMAN
Commissioner and Associate Member
Research, Development and
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Enclosure
cc: Legislative Analyst's Office

**California Energy Commission's Semi-Annual Report
Concerning the Public Interest Energy Research Program
(November 1, 2002 through April 30, 2003)**

In accordance with Public Resources Code (PRC) Section 25620.5(h), this document constitutes the California Energy Commission's *Semi-Annual Report* for the Public Interest Energy Research (PIER) Program, covering the period November 1, 2002 through April 30, 2003. (The Legislative Analyst has requested that all PIER Program semi-annual reports be submitted on or before June 1 and December 1 of each year.)

This report provides the required "evaluation of the progress and a status of the PIER Program's implementation" for this six-month period. It also provides input for the Energy Commission's more detailed *Annual Report Concerning the Public Interest Energy Research Program* (hereafter referred to as *Annual PIER Report*) required by PRC Section 25620.8.

I. PIER PROGRAM AREA FUNDING STATUS

On February 25-26, 2003 PIER Team Leads made a series of presentations to the Commission's Research, Development and Demonstration (RD&D) Committee outlining their proposals for new research efforts to be initiated between January 2003 and June 2004. Two funding levels were offered each of the six PIER Subject Areas, a "Core" budget and an "Enhanced" budget. The Core budgets included logical extensions of current programs, while the Enhanced budgets added significant new programs or major augmentations to existing programs. The proposed funding is summarized in the following sections.

1. Energy Systems Integration

During this reporting period, the team accomplished the following:

- **Electric System Seismic Safety and Reliability Project**

During this reporting period, researchers tested new composite materials and anchorage designs to help prevent the destruction of 500kV transformer bushings during earthquakes. Based on these results, PG&E now procures only 500kV composite bushings for new orders. Not only are these bushings more rugged during earthquakes, they require less maintenance as well. This results in cost avoidance to PG&E of approximately \$100,000/year. Although the bushings can be replaced after an earthquake, the loss of a 500kV substation could not only affect electricity in California, but possibly disrupt service in surrounding states. Also, the repair of substations could involve a significant amount of time –

at the very least, several hours – during the crucial time following a disaster.

- **Electric System Seismic Safety and Reliability Project**

Like the electric circuits in our homes, substations are equipped with disconnect switches used for routing power to the desired circuit, or shutting down an electrical line for a variety of reasons – whether it be damaged equipment, routine maintenance or a downed power line. Any time work is done on power lines in your neighborhood, a disconnect switch is used to shut down a specific area for the safety of the workers. As you might imagine, there are thousands of these switches in the state of California.

Like everything else, these switches must survive an earthquake for the system to remain functional. PEER researchers are developing a more cost-effective and resilient disconnect switch/support system, hoping to reduce the damage during a seismic event. This research has provided valuable data for the development of new industry standards to help reduce damage to these important substation components and other equipment in the event of a major earthquake. The implementation of these new industry standards has resulted in achieving superior performance of 230 kV disconnect switches with minor modifications. Cost avoided by not having to purchase more expensive switches is estimated to be \$250,000/ year to PG&E alone.

- **The development of a Sagging Line Mitigator (SLiM) Device**

The SLiM project developed a device that combats excess conductor sag in high voltage overhead transmission lines by reducing effective conductor length. Many older lines were constructed to 120°F maximum conductor temperature operation. Studies have shown that SLiM enables operation of such lines at a conductor temperature exceeding 200°F without compromise of line clearances or tensions. This can represent a multi-fold increase of rated line capacity. Due to its successful development in PIER, the device was chosen for a collaborative research effort by the Electric Power Research Institute (EPRI). This project will evaluate the SLiM device on three operating transmission lines. The project will provide participating utilities first-hand information on the performance of this new kind of line hardware device. The results of this project will position participating utilities as informed buyers and users of this new technology.

The Core budget for this area included projects in two focus areas: Distributed Energy Resource Integration and Demand Response. The Enhanced budget included funding for additional Distributed Energy Resource projects and a major

new Transmission program. The specific projects included in the proposed budget requests are shown in Table 1.

Table 1
Projects Included in Proposed Energy Systems Integration Budget

Proposed Project Areas	Core Budget (\$ mil.)	Enhanced Budget (\$ mil.)
<i>Distributed Energy Resource Integration:</i>		
Market Design and Integration Projects	1.2	
Regional Grid Benefit Validation Demonstrations	2.0	
Interconnection Equipment and Installation Cost Reduction	0.8	
Grid Effects/DG Penetration Testing	3.0	
Power Electronics for Interconnection Equipment		1.25
<i>Demand Response:</i>		
Develop Automatic DR Strategies	0.5	
Develop Lower Cost DR Technologies with Greater Functionality	1.5	
Two Utility Case Studies to Develop Understanding of Customer Responses	0.5	
Implement R&D Agenda for CAISO	0.5	
Develop Sustainable Test Bed for Measuring Benefits from DR Market Integration	2.0	
C&C Integration	3.0	
<i>Transmission:</i>		
Specific program to be determined with input from stakeholders		4-12
Totals	15.0	5.25-13

2. Buildings End-Use Energy Efficiency

During this reporting period, the team accomplished the following:

- **Innovative Classroom Lighting System**

The PIER Buildings Team began the \$5 million Lighting Research Program in late 2002. In early 2003, one team member, the Finelite Corporation in Fremont, California, developed an innovative classroom lighting system. The new system, which requires 33 percent fewer fixtures, includes an impressive number of features and benefits, including a patented 96 percent reflective paint combined with high-performance lamps and ballasts for a 25 percent system efficiency improvement. The direct/indirect design improves lighting quality by reducing glare and the integrated controls offer easier design, installation, and commissioning. The overall package promises to reduce energy use by 30-50 percent with an expected 2-3 year payback. Finelite built a fully-equipped classroom at the manufacturing plant to test the lighting system, and plans to demonstrate the classroom lighting system in six school districts starting in the fall semester of 2003.

- **Integrated Diagnostics for Package Rooftop Units**

The PIER-funded Purdue research group, led by Dr. James Braun, developed techniques for automatically detecting and diagnosing refrigerant undercharge, refrigerant blockage, low evaporator air flow, and blocked condenser coils in package AC equipment. These common faults result in high energy consumption and premature equipment failures. The work is so successful that Honeywell will be participating in a follow-up project to design a workable user interface and to integrate the diagnostics in commercial unit controllers. Honeywell has approximately a 70 percent market share for controllers of this equipment.

- **Integrated Diagnostics for Air Handling Units and Variable Air Volume Boxes**

The National Institute for Standards and Technology (NIST) research group, led by Dr. Steven Bushby, used PIER funding to develop and demonstrate software that detects stuck and leaking hot and chilled water valves, malfunctioning sensors and dampers, and improper control sequences in common large building air conditioning systems. These problems often go undetected for years and waste large amounts of energy. The team has engaged commercial controls companies for the next phase of development -- to further refine and deploy the techniques in commercial controls from Alerton, Delta Controls, and Automated Logic. PIER program staff expects that many other companies will also want to

implement the integrated diagnostics techniques once they become a marketing asset.

- **Low-Energy Cooling Design Review and Guidance**

One objective of the PIER-funded low-energy cooling design project is to evaluate the functionality, ease of use, and overall sufficiency of the computer models currently being developed in PIER-funded R&D within actual commercial building design, and to identify areas of needed improvement. Another objective is to mitigate the extra work and risk involved by innovative architects and engineers who specify low-energy systems in selected projects, resulting in increased use of such systems.

Recognizing that the San Diego climate offers unique possibilities for low energy design, the PIER Buildings Program successfully sponsored design review and guidance for the San Diego Children's Museum. PIER funding allowed a University California San Diego fluid mechanics professor, Dr. Paul Linden, to advise the project's architect, Rob Wellington Quigley, on building envelope and system control options to best make use of San Diego's climate to naturally cool and heat this innovative public building.

The Core budget for this area includes five major initiatives. Enhanced budgets are proposed for two focus areas. The specific projects included in the budget requests are shown in Table 2.

Table 2

Projects Included in Proposed Building End-Use Energy Efficiency Budget

Proposed Project Areas	Core Budget (\$ mil.)	Enhanced Budget (\$ mil.)
Improve Indoor Air Quality	6.0	
Reduce Electronic Equipment Energy Use	3.0	
Develop California Optimized Air Cooler	2.0	
Improve Efficiency of Building Operations—Diagnostics, Controls and Commissioning	2.4	
Phase 2/Title 24	2.1	
Zero Energy Homes		2.5
Phase 2/Energy Efficient Portable Classroom Research		
Total	15.5	2.5

3. Energy-Related Environmental Research

During this reporting period, the team accomplished the following:

- **Completed studies on *Global Climate Change and California: The Potential Implications for Ecosystems, Health, and the Economy***

The PIER Environmental Area, the Electric Power Research Institute, and a variety of researchers in the public and private sectors concluded a multi-year research study on the impacts of global climate change on California. This study culminated in a summary report and appendices addressing the effects of climate change on the State's water supplies, agriculture, coastal areas, vegetation, timber, and energy supply and demand. The researchers presented these studies at the California Energy Commission at a workshop on February 20 and 21, 2003. Their results will inform future research and policy planning in the area of global climate change and its affects on California.

Selected studies, and a brief summary of their results, are listed below.

➤ **The Impact of Climate Change on Energy Expenditures in California**

This study used a national cross-sectional analysis and detailed data from California to examine the sensitivity of energy expenditures to climate change in the state. The results suggest that warming will increase average energy expenditures in residential and commercial buildings and cause damages, but that the effects across the state will not be uniform. Northern and mountainous counties are more likely to *reduce* energy expenditures and the Central Valley and southern counties are more likely to *increase* energy expenditures. Modeling results suggest that by 2020 increased energy expenditures could range from \$350 million to nearly \$2 billion.

➤ **The Effects of Climate Change on Yields and Water Use of Major California Crops**

The objectives of this research were to develop crop yield response functions that estimate the effect of changes in temperature and precipitation on yields of major crops in California, and estimate changes in evapotranspiration (ET) for these same crops. The study produced simulations of the effect of climate change on crop yields and water use based on a host of climatic variables, and revealed four general themes: (1) warming during the crop-growing season is generally beneficial to California's cooler regions, but adversely affects the San Joaquin/desert region; (2) warming generally

increases crop water demand (i.e., most regions show a pattern of increased water use); (3) the “CO₂ fertilizer effect” increases yield in areas where climate change was beneficial and offsets or mitigates the negative effects of climate change in regions where climatic variables reduce yields; and (4) technological improvements could increase crop yields dramatically. Overall, the study concluded that, given adequate water supplies, crop yields could increase to the extent that the current production could be grown on fewer acres.

➤ **Climate Change and Urbanization in California: Potential Effects on the Extent and Distribution of Major Vegetation Community Types;**

This study integrated information on current distributions of major vegetation community types in California with projections of climate change and future urbanization patterns, to identify how these community types might be altered. Researchers estimated that:

- climate change will substantially change the distribution and spatial extent of many vegetation community types in California
- increased urbanization will most affect Mediterranean shrubland (e.g., southern coastal scrub), temperate mixed xeromorphic (e.g., oak and juniper) woodlands, and maritime temperate forests (e.g., redwoods)
- climate change would have a much larger impact on the extent of the major vegetation community types studied than would urbanization
- in a landscape context, habitat heterogeneity in California may be reduced if climate change results in lowered soil moisture or substantially higher temperatures, although diversity could increase slightly if climate change results in wetter conditions with smaller increases in temperature
- Coastal sage scrub is particularly threatened by future urbanization (with more than a 20% loss of existing habitat expected by 2100), and climate change could triple that habitat loss.

➤ **Economic Impact of Sea Level Rise on Coastal Structures in California**

This study assessed the economic costs of sea level rise on a statewide basis for California, focusing on impacts to coastal structures. To estimate the cost of sea level rise for California, researchers considered: (1) areas that are vulnerable to inundation and when they would become vulnerable; (2) the expected response from property owners and governments to the threat of inundation; and (3) the costs of plausible alternative responses. Results showed that the total estimated economic impact of a 100-cm (39-inch) sea level rise in California varies from \$148 million to \$635 million.

➤ **Climate Warming and Future California Water Management**

This study concluded that climate warming will have significant impacts on California's water availability and quality. Researchers generated a climate-perturbed time series of rim inflows, reservoir evaporation rates, local surface water accretions, and groundwater inflows for California's **intertied** water system, which will form a basis for water supply system planning and management studies using the CALVIN economic engineering optimization model. Researchers compared climate warming impacts with estimated changes in urban and agricultural water use between now and 2100. All scenarios showed an earlier annual streamflow volume, which agrees with less comprehensive previous studies. The dry scenario showed a 30% reduction in hydropower generation by 2100. For the same scenario, the CALVIN model also showed that to balance water needs in the State, environmental flows had to be reduced beyond current legally acceptable levels. Finally, flooding was shown to be a major problem under some of the wet warming climate scenarios. Under one such scenario, flows would be well beyond the control capacity of existing, proposed, or (most likely) plausible reservoir capacities.

The Core budget for this area is allocated among four focus areas. Projects are proposed in two additional focus areas under the Enhanced budget proposal. The specific projects included in the budget requests are shown in Table 3.

Table 3

Projects Included in Proposed Energy-Related Environmental Research Budget

Proposed Project Areas	Core Budget (\$ mil.)	Enhanced Budget (\$ mil.)
Improved instrumentation and comparative analysis of emerging DG technologies	2.0	
Bio-indicators for assessing aquatic ecosystem health	1.5	
Improved wildlife management tools	1.5	
Develop baseline climate data and evaluate carbon control alternatives.	3.0	
Improved metrics for health forest and impacts estimates from biomass harvesting		1.0
Enhanced tools and data for assessing climatic impacts from carbon buildup for California		2.0
Totals	8.0	3.0

4. Environmentally-Preferred Advanced Generation

During this reporting period, the team accomplished the following:

- **First Commercial Demonstration of an Ultra-Low Emissions Gas Turbine in a Distributed Generation Power Plant**

Since November 2002, a 1.4 MW Kawasaki gas turbine equipped with a Xonon® Cool Combustion system developed by Catalytica Energy Systems has been providing electricity and steam to operate the Sonoma Developmental Center, a state-run facility for 800 developmentally disabled patients in Eldridge, California. NOx emissions have been less than 2 ppm, compared with 20-30 ppm for the same turbine before the Xonon retrofit. This breakthrough Xonon technology, which has been developed with co-funding from PIER/EPAG since 1998, controls the combustion process to virtually eliminate the creation of NOx. It achieves emissions levels lower than those of central station power facilities, without resorting to Selective

Catalytic Reduction (SCR) or other post combustion control technologies, which require large, expensive installations and the use of toxic chemicals.

- **Successful Test Firing of a Zero Emission Gas Generator**

Clean Energy Systems (CES) completed their successful test firing of a new zero emission combustor ("gas generator"). PIER/EPAG has been working in concert with DOE to co-fund CES in the development of an efficient electricity generation technology that not only eliminates the emission of pollutants, but also mitigates global warming by allowing for the easy, cost effective separation and collection of CO₂.

The CO₂ can then be sequestered, or used for industrial applications such as enhanced oil recovery. This work was initiated with a PIER/EISG grant in 1999 when CES successfully built and demonstrated a unique bench-scale gas generator. DOE then funded CES to build and test a 10 MW_e gas generator. The recent successful completion of this project paves the way for continuation of a current PIER/EPAG co-funded project to demonstrate the long term durability of the gas generator at a Mirant power plant in Antioch, California, where it will drive a steam turbine to generate 500 kW of electricity for two years.

- **Advanced Laser Ignition Integrated Advanced Reciprocating Internal Combustion Engine (ARICE) System for Distributed Generation in California**

This project will further the goals of the ARICE Collaborative by developing, integrating, and demonstrating an advanced laser ignition system in an advanced reciprocating internal combustion engine that meets the 2007 CARB emissions and ARICE installed cost targets and improves efficiency by more than 20%. The Energy Commission collaborated with USDoe to set up a consortium to research and develop the Advanced Laser Ignition System. The Energy Commission is participating in this consortium and has awarded one additional ARICE contract during this reporting period.

- **Coordination with USDoe's Advanced Reciprocating Engines Program (ARES)**

The PIER EPAG team continued the coordination between USDoe's ARES program and the Energy Commission's Advanced Reciprocating Internal Combustion Engines ARICE program to develop cleaner and more efficient engines for distributed generation in California. The staff participated in two significant events during this period: (1) Stationary Natural Gas Engine Emission Control Systems Roundtable organized by the Argonne National Laboratory, Argonne, IL on February 10-11, 2003; and (2) Annual Peer Review meeting of the USDoe's University Reciprocating Engines Program

(UREP) held at the National Energy Technology Laboratory (NETL), Morgantown WV on April 9-10, 2003.

- **Advanced Combined Heat and Power Technologies for Federal Facilities**

The Energy Commission received a USDoE Federal Energy Management Program (FEMP) grant of \$150,044.00 to evaluate the feasibility and facilitate the implementation of advanced combined heat and power (CHP, commonly know as cogeneration) technologies at federal sites in California. The Energy Commission, through its grantee Energy Nexus Group, Inc., has selected four federal sites in California for this project targeted for completion in December 2003.

The Core budget for this area is allocated among three focus areas. Projects are proposed in two additional focus areas under the Enhanced budget proposal. The specific projects included in the budget requests are shown in Table 4.

Table 4
Projects Included in Proposed Environmentally-Preferred
Advanced Generation Budget

Proposed Project Areas	Core Budget (\$ mil.)
Demonstration of clean, advanced turbine technologies	2.0
Combined heat and power	6.0
Coordination of ASERTTI DG protocols with ESI distribution system impacts measurement	0.5
Totals	8.5

5. Industrial/Agriculture/Water End-Use Energy Efficiency

During this reporting period, the team accomplished the following:

- **PIER IAW successfully concludes an RFP for Energy Efficiency Technologies for Food Processing Industry**

In November 2002 the PIER program through the California Institute of Energy Efficiency (CIEE) issued a solicitation. Seven finalists have been selected for a potential funding of \$2.4 million out of a total of 40 who requested a total of \$16 million. The research projects selected address important energy-related food industry issues consistent with the PIER

mission. These awards will be monitored and managed to ensure performance and technology transfer. California's food processors are major users of energy and are a critical part of California's economy. The selected projects. When complete, should provide commercially available energy technologies that help California food processing industry reduce its electricity costs, natural gas consumption and reduce harmful emissions.

The RFP solicited projects responsive to industry needs. In 2002, PIER, with help from California Institute for Food and Agriculture Research (CIFAR) at UC Davis convened an industry group, Food Industry Advisory Committee (FIAC) and developed a RD&D roadmap based on the industry energy needs and related issues. The PIER Food Industry Energy Research RFP was released to seek research projects that address the issues identified by the FIAC. The program focuses on promising research projects that address important energy-related food industry issues consistent with the PIER mission and Commission Energy Plan.

The food processing industry is the third largest user of electricity and consumes about 5.25% of all the electrical energy used in California. It is also a major user of thermal energy. The electricity is primarily used for refrigeration, freezing, fluid separation, water treatment, electrical motors and pumps.

- **Saving Energy and Improving Power Quality**

Digital computerized systems create "harmonics" in the electrical system that powers them. These harmonics generate heat in the electrical wiring, building power transformers and the computer-related equipment connected to the computer network. This generated heat degrades the efficiency of the equipment and results in increased loads on the building's air conditioner system.

Historically, when harmonic problems were identified, businesses purchased harmonics mitigation devices that would block or reduce the harmonics. In effect, many of these harmonic mitigation devices were no more than a temporary band aid for a long-term problem. In November and December 2002, the PIER program and the EPRI Power Electronics Applications Center (PEAC) completed field tests which evaluated a new technology that not only mitigates the harmonics problem but also provides energy efficiency improvements to the facilities they support.

PIER funding allowed an evaluation of a harmonics mitigation device, developed by Harmonics Limited, Inc., and specifically designed to address the high 3rd harmonics generated by digital computer systems. Field analyses were performed on the State of California Franchise Tax Board (FTB) data processing facility in Sacramento. The FTB facility contains a large number of computer work stations and digital computer systems. The field testing

confirmed both a reduction in the undesirable harmonics and a continuous 2 to 6 percent reduction in the facility's electrical loads. Energy savings of this magnitude will result in a commercial payback for these devices of a few years. The observed variance of the energy savings over the two-month period was due to the variability of the operations of the FTB facility. Although the electrical load reduction may seem small, these systems have an estimated life span of 20-30 years and the energy savings continue for the life of the harmonics mitigation device.

- **Real-Time Information Tool**

During April 2003, the PIER program completed a research project demonstrating a Real Time Information Tool at two industrial sites. This information tool will be an integral part of the automatic response equipment that a customer would need to participate in a Demand Response Program and Critical Pricing Program. Developed in response to an identified need by the industrial customers during California's 2001 energy crisis, the tool continuously collects and stores meter data, giving the end user an ability to respond to requests for load curtailment and other system needs based on the end user's own priorities and decision-making criteria. The tool has a non-proprietary, open architecture that lends itself to multiple use and interface with different systems. This tool using the XML Schema will be in the public domain and, with slight modifications, can be used for a variety of applications.

The tool is now being adopted for use in developing a Demand Response Program initiated by the California Public Utility Commission. The tool will be a key component in a demand response program for industrial/commercial and residential rate-payers and will establish customers' eligibility to receive rebates. By using the PIER-developed information tool, a centralized data base will be developed which collects all the desired data elements, ensures consistent and timely data identification and collection, and organizes and stores the data for future research analysis.

- **PIER IAW funded Thermosorber Project (Energy-Efficient Refrigeration and Heating in the Food processing Industry)**

Many food and beverage industries require simultaneous heating and cooling/refrigeration in their operations. Generally, gas-fired boilers supply the heat while electrically-driven refrigeration systems provide the cooling. The cost of the energy consumed by these devices is a major concern for the food and beverage industries. An innovative Gas-fired Hot Water Heat Pump (GHWHP) Thermosorber technology shows promise of significantly reducing these energy costs by concurrently producing both the hot water and chilling needed for plant operations. At a processing plant in Modesto, a PIER-funded GHWHP project reduced the electrical load by 70 percent and the natural gas demand by 20 percent. The site is now being used to showcase

the GHWHP technology for other food processing industry members who are interested in using this technology at their sites. In the months of March and April, the site was visited by other poultry processors and dairy operations staff, including one potential end-user in the final stages of making a decision about installing this technology at its own expense. The significance of this development is that the GHWHP technology is now on the verge of being commercialized without any further PIER assistance, thus attaining a major PIER program goal.

The Core budget for this area is divided between two focus areas. Projects are proposed in one additional focus area under the enhanced budget proposal. The specific projects included in the budget requests are shown in Table 5.

Table 5
Projects Included in Proposed Industrial/Agriculture/Water
End-Use Energy Efficiency Budget

Proposed Project Areas	Core Budget (\$ mil.)	Enhanced Budget (\$ mil.)
Industrial process and utility needs	3.0	
Improved energy efficiency for water treatment, use and transportation	3.0	
Electrical energy storage technologies		5.0
Totals	6.0	5.0

6. Renewable Energy Technologies

During this reporting period, the team accomplished the following:

- **California Ocean Wave Energy Resource and Technology Evaluation**

This contract sought to assess the amount of ocean wave energy resource located off of California's coast, and evaluate the technical, economic and environmental feasibility of harnessing the ocean wave energy. A draft final report has been submitted by the contractor and is currently under review. Preliminary analyses shows there may be a significant amount of energy wave resource located off the coast that may be reasonably harnessed over the next decades.

- **Hetch Hetchy Programmatic Contract**

A major purpose of this contract is to identify renewable resources that could be helpful in making California's electricity more affordable and diverse. As a result of renewable resource and transmission analyses conducted under this contract, there appears to be over 4000 MWs of renewable energy resources in eastern California and adjacent states that could be harnessed for use. The final analyses are not due on this contract until next year, but the results will be provided to the California Public Utilities Commission for use in assessing the state's ability to achieve the Renewable Portfolio Standard.

- **Distributed Generation Drivetrain for MW Turbines**

This contract will develop an innovative new design for wind turbine generators that will significantly improve reliability and help reduce costs of new wind turbines. Clipper Wind has completed test results that indicate the distributed generator approach is on track in meeting technical performance goals. As wind energy is expected to play a major role in the state's RPS goals, the results are encouraging that newly developed wind will be more reliable and less expensive.

The Core budget for this area is allocated among three major new initiatives. Two major efforts to accelerate the commercialization of renewables in California are included in the Enhanced budget proposal. The specific projects included in the budget requests are shown in Table 6.

Table 6
Projects Included in Proposed Renewable Energy Technologies Budget

Proposed Project Areas	Core Budget (\$ mil.)	Enhanced Budget (\$ mil.)
Renewable Portfolio Standard Program Planning:		
Accelerating and extending RPS planning tools	1.0	
Assessing ways to better integrate renewables into the grid	1.0	
Coordinating technology development and deployment	1.5	
Building off successes of early deployment	4.0	
Expanded technology development and deployment	5.5	
Accelerated renewables development and deployment options		4.0
Totals	13.0	4.0

II. Strategic Funding Decisions from the Commission's RD&D Committee

The RD&D Committee deliberated after hearing the presentations of the proposed PIER budgets for January 2003 through June 2004 and decided to approve the funding of all proposed Core areas with the exception of some in the Industrial Energy Efficiency area. Enhanced budgets are being reconsidered and funded on a case-by-case basis as specific contracts are brought to the RD&D Committee for approval. The Core budgets approved for PIER for the period are summarized by PIER Subject Area in Table 7. Table 8 lists two Enhanced budget projects approved to date, a project to increase the market acceptance of renewables technologies and a crosscutting research program for electric energy storage technologies.

Table 7

Approved Core Funding for 1/03—6/04 by PIER Subject Area

PIER Subject Area	Approved Core Budget for 1/03—6/04 (\$ mil.)
Energy Systems Integration	15.0
Buildings End-Use Energy Efficiency	15.5
Environmentally-Preferred Advanced Generation	8.5
Energy-Related Environmental Research	8.0
Renewable Energy Technologies	13.0
Industrial/Agriculture/Water End-Use Energy Efficiency	6.0
Total	66.0

Table 8Enhanced Budget Projects Approved to Date
by the Commission R&D Committee

Approved Enhanced Budget Projects	Funding (\$ mil.)
<i>Renewable Energy Technologies:</i>	
Community Choice Aggregation Pilot Project to maximize inclusion of renewable energy	0.7
<i>Industrial/Agriculture/Water End-Use Energy Efficiency:</i>	
Electric Energy Storage Technologies	5.0
<i>Environmentally-Preferred Advanced Generation:</i>	
Fuel cell/gas turbine hybrids	2.0
Collaborative technology development for advanced turbine technology	2.0
Total	9.7

III. PIER PROJECTS APPROVED, January 1, 2003 – April 30, 2003

- California Wind Energy Consortium

The goals of this project are to establish the Consortium to coordinate the development of wind energy systems in California, to maintain a wind database, to develop a wind energy technician training plan, to prepare White Papers on current industry issues, and to develop a wind anemometer loan program plan.

This project will provide coordination among wind energy developers in California to reduce the cost of wind energy development, wind turbine siting, and wind system operation and maintenance. As a result the cost of electricity from wind will be reduced to California customers.

- Acoustic Stimulation for Aluminum Castings to Conserve Metal and Electricity

This project will develop and demonstrate acoustic stimulation technology commercially at aluminum foundries. The technology consists of an audio device vibrating at lower than ultrasound frequencies at high amplitudes inserted into the risers of molds for metal castings. Laboratory tests have shown acoustic stimulation will lower pouring temperatures and delay solidification of molten metal. If successful, this project will reduce energy consumption (and fuel costs) and will increase the cast metal yield.

- Support for Independent Review Panel (IRP)

The purpose of this contract is to fund the California Council of Science and Technology, to support an independent panel to review the Public Interest Energy Research (PIER) Program. Both administrative support and technical support for researching and report writing will be provided to the panel.

This panel will help PIER management to keep the focus of PIER RD&D on the most important California electricity issues and to maintain a high-quality, high-impact RD&D program.

- Advanced Laser Ignition System Integrated ARICE Project
(A Consortium of CEC's ARICE and USDOE's ARES Programs)

Success of the project will lead to significantly higher electricity generation efficiency, a slight increase in electric capacity of the engine-generator, reduced down time, and lower maintenance costs.

Electric customers will benefit from increased on-site electricity reliability, lower electricity costs at the times of peak electric load, and lower overall on-site energy costs, especially where the engine waste heat can be used for process or space conditioning requirements.

- Indoor Environmental Quality and Emissions Measurements

This contract seeks to obtain information that can be used to better understand and quantify the relationship between Indoor Environmental

Quality (IEQ) and energy use and to provide guidance for achieving both improved energy efficiency and improved IEQ. The goal is to conduct research to quantify the effects of building characteristics, energy use and practices, and sources of indoor pollution on indoor environmental quality.

With the knowledge gained from this project, building designers and operators can modify building design and operation for lower fuel costs, while maintaining or improving occupant comfort and safety.

- Distributed Energy Resources Integration Technology Assessment and Development Analyses

This project will perform technology, market and consumer-needs assessments for the Distributed Energy Resource Integration research program in order to develop research priorities and plans, implementation plans and evaluations of the program.

The information and knowledge gained from this project will be used to determine technology development needed to successfully integrate small generating systems into the electrical power grid in a way that meets customer needs and expectations. Market success of DER technologies will result in electricity cost savings, enhanced local electricity reliability, and will bolster the local electrical distribution system.

- Methane Sensor for Control and Automation

This contract will evaluate the feasibility of a new gas sensor for the detection and measurement of methane to control/automate the operation of fuel cells.

When implemented in landfills, this technology will improve landfill-gas-to-electricity conversion efficiency, enhance system reliability and lower operation and maintenance costs, thereby reducing the cost of producing electricity from landfill gas.

- Hydrogen- Methane Waste Fermentation for Clean Electricity Generation

This project will demonstrate the feasibility of two-phase anaerobic digestion processes for the production of hydrogen-methane mixtures with high volumetric fractions (25-50%) of hydrogen. The use of a hydrogen-rich mixture as a fuel is known to reduce NO_x production ten-fold compared to the use of methane.

Success of this project will offer a low-cost option for reducing NO_x emissions from gas-fired boilers, small turbines, and engines. The public will benefit from cleaner air and lower on-site electricity costs if other NO_x control options were required.

- Instant Snap-in Load Shed Device for Incandescent Lighting

The project seeks to determine the feasibility of developing a snap-in socket adaptor for incandescent lighting that would allow for an instant 30 to 50% reduction in electric energy consumption during peak demand.

Successful development and use of this device will help reduce peak electricity demand, increase the reliability for all electricity users and reduce the need for additional investment in peak generating capacity.

- Novel Approaches to Ignition Enhancement of Natural Gas Under Engine-Like Conditions

This project will assess the feasibility of using C₂-hydrocarbons as an ignition enhancer for natural gas under lean burn conditions in an internal combustion engine. Variations of the proposed ignition enhancer will be formulated and tested as part of the project. If successful, the project offers an option for reducing NO_x emissions in natural gas engines.

Demonstrated success of the gas C₂-hydrocarbons to reduce NO_x will reduce the cost of meeting California emissions requirements, reducing the cost of electricity generated by on-site generators.

- Integrating Evaporative Cooling with Dynamic Insulation for Occupant Thermal Comfort

This contract will explore the feasibility of reducing peak cooling loads and increasing design day comfort in evaporatively cooled residences. This will be achieved through the construction of a dynamic building envelope that uses exfiltrating air to reduce exterior wall and ceiling conduction loads and lower interior surface temperatures.

If this technique proves to be feasible, homeowners will be able to maintain or improve comfort on hot summer days while reducing their use of electricity during peak load days. The homeowners will save on their electricity costs, and all electric ratepayers will benefit by reduced peak demand, increased electricity reliability and reduced electricity costs.

- Dry Steam Scrubbing for Impurity Removal from Geothermal Steam

The project will investigate the feasibility of developing a steam scrubbing technology that effectively removes and/or treats corrosive hydrogen chloride (HCl) in geothermal steam without superheat quenching or steam condensation. This technology will maximize the amount of mass and energy that can be retained for power generation.

The demonstration of the feasibility of this dry steam scrubbing technique will reduce the operating costs for geothermal power plants and the costs of electricity for all ratepayers.

- A Low-NO_x Porous Ceramic Burner Performance Study

The study will research the feasibility of developing a low NO_x porous ceramic burner design that meets emission requirements, eliminates the need for post-combustion emissions controls, and produces a radiation heat release rate higher than those of existing free-flame burners.

Through the use of a commercially successful porous ceramic burner, NO_x emissions requirements can be met at a lower cost than the cost of post-combustion controls. This will reduce the costs of small steam generating plants and the electricity that they generate as well as the costs of steam for process applications for California industries.

- Geothermal Reclaimed Water Turbine

The project will research the feasibility of installing down-hole turbines into geothermal injection wells at the Geysers.

The cost of electricity from geothermal generating stations will be reduced, reducing the cost of electricity for all ratepayers.

- Plastic Solar Cell

This project will demonstrate the feasibility of bench-scale fabrication of a plastic solar cell, and will provide a characterization of the cell based on a new nano-technology.

If successful, this project will lead to additional development of techniques for fabricating solar cells from plastic materials. Costs of solar cells will be reduced, making electricity production for photovoltaics cheaper. Californians will benefit from increased energy supply security by the substitution of renewable on-site electricity for central-station electricity increasingly generated from natural gas.

- Novel Nanocomposite Carbon Molecular Sieve Membranes

This project will demonstrate the feasibility of utilizing novel nanocomposite mixed matrix membranes in separating hydrogen and CO₂ from binary, ternary, and quaternary gas mixtures of relevance to power generation.

Successful development and application of the sieve membranes to advanced gas turbine power cycles is expected to result in lower cost and more efficient separation of hydrogen, CO₂ and other gases. This will reduce the cost of electricity generated by these cycles and may also enhance the prospects for feasible CO₂ sequestration options to reduce greenhouse gas emissions.

- Build and Test a 3 kW Prototype of a Co-Axial, Multi-Rotor Wind Turbine

This project will determine the feasibility of a low cost wind turbine design that incorporates seven rotors on a horizontal shaft. A 3 kW prototype will be fabricated and tested as part of the project.

The lower-cost wind turbine resulting from this project will generate electricity from wind at a cost lower than that generated by existing wind turbines.

- Feasibility of a Hydrogen Blower Design for Fuel Cell Recirculation Applications

This project will demonstrate the feasibility of using a unique blower design for recirculation of anode tail-gas in a hydrogen-fueled fuel cell system application.

Recirculation of the tail gas will increase the efficiency of the fuel cell and reduce the cost of electricity and heat supplied by the fuel cell system.

- Real Time Transmission Line Ratings for Sacramento Area

This contract will demonstrate the feasibility of implementing real-time transmission line ratings for a large multi-utility area under normal system conditions, by linking the benefits from real time thermal ratings with simultaneous mitigation of voltage constraints and by developing ratings forecasting methods.

The use of real time transmission line ratings will allow transmission operators to increase the amount of electrical power flowing through the

lines, increasing the efficiency of the transmission system, improving access of electric customers to generating capacity, and thereby increasing the reliability and reducing the cost of electricity to customers.

- Oil-Field Flare Gases Electricity Project

The project consists of a series of demonstrations of technologies to recover and convert in to electricity a wide range of flare and waste gases from California's oil fields that today are difficult or impossible to recover. The gas from oil wells has a wide variety of constituents, and in some instances, the fugitive gas from operations is too weak even to flare and may leak into the atmosphere. The demonstration will cover the recovery of these gases as well.

Recovery and use of the flare gases will add to California electricity generating capacity, reduce the cost of oil production in California, and reduce emissions of greenhouse gases.

- Urban Heat Island Modeling

Using state-of-the-science meteorological and air quality models and the most updated meteorological and source data, the proposed project will develop a heat island reduction model for two to three ozone non-attainment areas in California. The study will assess the potential energy reductions and ozone air quality improvements of heat island reduction measures. The proposed study hopes to develop a scientifically-sound heat island reduction model supported by the EPA and ARB.

The study is expected to lead to strategies to reduce energy use and to reduce ozone concentrations in the areas being studied.

- Collaborative Research Projects

See Section IV.

- Decreasing electric demand in California oilfield operations by reducing excess water production

This contract will analyze well geology and demonstrate suitable technological solutions that can reduce electric power consumption in California oil fields by reducing the excess water production.

The implementation of the solutions identified will reduce the cost of oil produced in California and will reduce the strain on the electricity system.

IV. PIER ELECTRICITY INNOVATION INSTITUTE (E21) RESEARCH FUNDING STATUS

PIER funding of collaborative efforts headed by other energy research organizations allows the Energy Commission to participate in many statewide and national RD&D activities, thus allowing California to provide input and receive benefits from these broadly funded RD&D efforts.

During the current reporting period, the Energy Commission defined and began to implement 10 projects under our collaborative research agreement with the E2I.

Program Area	Title	Amount
EPAG	Determine RD&D Priorities to Overcome High Efficiency CHP Technical Barriers	\$ \$36,894
	Stirling Engines	\$ 143,119
Environmental	El Dorado Spray Enhancement for Dry Cooling	\$ 715,776
	Water Conservation in Electricity Generation	\$ 800,000
	DER Environmental Benefits/Impacts	\$ 150,000
	Assessment of Potential Health and Ecological Risks Associated with CO2 Capture, Transport, and Sequestration	\$ 25,000
ESI	DER Interconnection and Market Integration	\$ 250,000
	Sagging Line Mitigator (SLIM) Full Scale Demonstration	\$ 83,720
Buildings	Power Supplies Efficiency Improvement	\$ 577,042
Ind/Ag/Water	Demand Response Database	\$ 372,060

V. ENERGY INNOVATIONS SMALL GRANT (EISG) FUNDING STATUS

1. PROGRAM REVIEW

The Energy Innovations Small Grants Program has received an independent program review during the past two quarters. The EISG review, chaired by Carl Weinberg (former vice-president of research at PG&E), resulted in recommendations including but not limited to:

Recommendations:

- The program should develop and implement a technology transfer plan.

- As a part of that plan, the program should strengthen the feasibility analysis reports generated at the completion of each grant project.

Small Grant Awards

The Energy Commission has released 15 solicitations through the PIER-funded EISG. It has approved 120 grants totaling \$8.7 million in awards through completion of the first 13 of these solicitations. Proposals submitted in the 14th solicitation (cycle 02-03) have completed the evaluation process through the Program and Technical Review Board (PTRB), which has recommended 9 awards, valued at \$674,000. These are awaiting approval from the RD&D Committee and Commission. The 15th solicitation was posted at the end of March 2003 with a proposal submission date of May 30, 2003.

Small Grant "Follow-on" Funding

A survey was conducted of the 47 grant projects completed by October 2002. Of the 42 that responded, 23 projects reported receiving follow-on funding totaling \$40.2 million. This level of follow-on funding can be taken as one measure of success given that EISG had invested only \$3.5 million in grant funds in the 47 completed projects.

Small Grant Research Reports

The following Feasibility Analysis Reports, which includes the project final report as an appendix, were published during the past six months.

- Grant 99-30, Publication Number P500-02-021F, "Direct Operation of Solid Oxide Fuel Cells on Natural Gas".
- Grant 99-38, Publication Number P500-02-035F, "The Anaerobic Pump Prototype Testing".
- Grant 99-10, Publication Number P500-03-016, "Development and Characterization of Improved Dye-Sensitized Nanocrystalline Solar Cells".
- Grant 99-19, Publication Number P500-03-017F, "Novel Composite Membranes for Fuel Cells".
- Grant 99-26, Publication Number P500-03-018F, "Catalytic Stabilizer for Industrial Gas Turbines".
- Grant 99-31, Publication Number P500-03-019F, "Non-Vacuum Thin-Film Photovoltaics Processes".

- Grant 00-10, Publication Number P500-03-015F, "Increasing Efficiency of Geothermal Energy Generation with High Resolution Seismic Imaging".

VI. OTHER PIER PROGRAM ACTIVITIES

A. Technology and Information Transfer/Reporting Activities

Technology and information transfer is critical to the success of any RD&D effort. Accordingly, during the past reporting period, the PIER program has performed the following activities:

The Energy Commission contracted with the Environmental Business Cluster (EBC), a member of the National Alliance of Clean Energy Business Incubators, to provide business consulting services to PIER contractors. Under the pilot program, there is funding to provide business consulting services and membership in the incubator to ten companies. Eight companies were selected from those who applied for business consulting services. The Cluster's Director has coordinated with company managers to define specific scopes of work for business consulting services from the EBC staff and expert consultants, including such activities as business plan and market strategy development, financing assistance and staff development. Due to the success of the efforts from Phase One, we are planning to fund the program for Phase Two.

PIER is also planning to participate in the industry growth forum (IGF) with the NREL in Austin, Texas in November, 2003. Venture capitalists and "angel investors" from throughout the country will serve as panelists for the IGF.

Several PIER "success stories" have resulted from the EBC assistance program.

- EBC assisted one company in development of strategy for discussions and negotiations with investors, bankers and owners of a power company, and convinced them to upgrade the power plant using the company's equipment.
- EBC helped with the development of a new business plan and assisted with negotiations on production of the first 10 units of equipment. EBC also assisted with a search for an intellectual property attorney and the company is now working to file a new patent.
- EBC provided assistance in moving the design of a product from early "breadboard" to a state of manufacturability. EBC provided

this company a marketing strategy, design of a website, and other collateral materials.

- EBC facilitated the design of a strategic plan for a company with a viable technology yet having economic hardships. EBC helped the company refine their business offerings and developed a marketing strategy to attract potential investors. A new CEO was hired and at this time, a \$100,000 good faith payment was made by a potential investor.

The Technology Transfer Program is also developing three new "PIER Success Story" fact sheets. To date, nine PIER projects have been showcased in the success stories:

- Catalytica low NOx catalytic combustion
- Real-time ratings of transmission lines
- Spray-enhanced dry cooling of power plants
- PowerLight Photovoltaic (PV) manufacturer
- Kalina cycle low-cost power generator
- Alzeta low NOx turbine
- Berkeley energy efficient lamp
- Distributed generation interconnection streamlining
- Energy efficient fume hood technology

1. Public Interest Energy Research Staff and Management Activities

The PIER Program management and staff recently co-sponsored and participated in a number of technology transfer events and activities:

- Co-sponsored with the DOE a workshop on Electric Energy Storage Technologies in Sacramento February 13, 2003
- Co-sponsored with the American Water Works Association Research Federation a workshop in Sacramento February 25-26, 2003
- Made a presentation to the southern California section of the Association of Energy Engineers at their annual meeting March 20, 2003 in La Mirada, California
- Sponsored informational workshops on January 28, 2003 at University of California Los Angeles and January 29, 2003 at University of California, Berkeley to solicit proposals for research projects through the PIER Environmental Area's Exploratory Grant Program
- 3/17/03 presentation to the Fuel Cell Investment Summit The trip was sponsored by: The Connecticut Clean Energy Fund, The U.S. Fuel Cell Council, and Fuel Cells 2000. This meeting will be held in Uncasville,

Connecticut. This presentation explained PIER research activities, primarily in the fuel cell technology areas.

- 11/11/02 presentation at CADER in San Diego on creating a Combined Heat and Power Center in California, to be funded by US DOE.
- 11/13-15/02 presentation to the Association of State Energy Research and Technology Transfer Institutions Steering Committee in Sonoma on the status of the development of national testing and performance evaluation protocols for distributed generation technologies, the project is co funded by US DOE.
- 1/30-31/03 presentation to the University of California at Irvine Fuel Cell Advisory Committee Meeting in Irvine on the future high priority research activities.
- 3/4/03 presentation to the Electric Power Research Institute Distributed Resources Committee in San Francisco on co-funding a utility scale gas turbine demonstration project.
- 3/5-6/03 presentation to the US EPA Partnership Program in San Diego on a joint proposal to create a Southwest Combined Heat and Power Application Center in California funded by US DOE.
- 11/11/02 presentation at CADER in San Diego on creating a Combined Heat and Power Center in California, to be funded by US DOE.
- 11/13-15/02 presentation to the Association of State Energy Research and Technology Transfer Institutions Steering Committee in Sonoma on the status of the development of national testing and performance evaluation protocols for distributed generation technologies, the project is co funded by US DOE.
- Presentation at the California Ethanol Workshop, "Developing Ethanol's Role in California's Energy, Economic, and Environmental Future". April 14-15, 2003 in Sacramento, California.
- Gave a presentation on the Geothermal Program at the Geothermal Heat Pump Consortium's meeting February 11 , 2003 at Southern California Edison's Commercial Products Center Room in Irwindale, CA
- Spoke at the Biomass -to-Energy workshop December 2 and 3, 2002 at Tulelake, CA. The workshop focused on opportunities and technologies available to the Klamath Basin to convert biomass to energy.

- Presented "The Value of Building Integrated Photovoltaics" paper at the Utility Photovoltaic Experience conference in Austin, TX November 14, 2002
- Presented "Photovoltaic Research Activities at PIER" at the RAPID PV Steering Committee workshop in Palo Alto, CA October 31, 2002
- Presented "Landfill Gas Markets in California" at the WasteCon 2002 Conference in Long Beach, CA October 29, 2002
- Program manager Terry Surles keynoted the California Wind Energy Consortium Forum December 17-18, 2002 at University of California, Davis
- Hosted a Demand Response Enabling Technology Development TAC (Technical Advisory Committee) meeting at UC Berkeley February 28, 2003
- Gave a presentation to the CBE (Center for the Built Environment) Industry Advisory Board on the Demand Response Enabling Technology Development project at UC Berkeley April 24, 2003
- Made a presentation on PIER-related fuel cell research to the Fuel Cell Investment Summit in Uncasville, Connecticut March 17, 2003
- Participated in the California Wind energy Consortium Forum on December 17-18, 2002 at the University of California, Davis campus. The PIER Renewables program awarded funding to UC Davis that established the California Wind Energy Consortium to address specific tasks to support the California wind industry.

B. PIER PROGRAM EVALUATION EFFORTS

1. Independent Review Panel

AB 1890 modified Public Resources Code (PRC Section 25620.9) and required that an independent panel of experts be assembled to review the public value of the PIER Program. The original panel submitted their written evaluations to the Governor and Legislature in March 2000 and March 2001.

SB 1038, enacted January 2003, mandates a new panel of experts to provide a follow-on review of the PIER Program. A panel of independent experts in energy technology R&D, economics and markets, energy policy, environmental impacts, public health and government systems has been

recently designated by the Commission R&D Committee. New panel members are:

Robert P. Caren, Board Member, Litex Inc.,
Chairman, Hawkeye Enterprises

Linda R. Cohen, Professor of Economics,
University of California, Irvine

T. Kenneth Fowler, Professor Emeritus,
Nuclear Engineering, University of California, Berkeley

Harold M. (Hub) Hubbard, Energy Consultant,
Energy and Environmental Issues

Alan C. Lloyd, Chairman, California Air Resources Board

Johnetta A. MacCalla, Chief Executive Officer,
Automated Switching and Controls Inc.

William J. McLean, Director, Combustion Research Facility,
Sandia National Laboratories, Livermore, CA

Peter M. Miller, Natural Resources Defense Council

Maxine L. Savitz, Ret., General Manager,
Technology Partnerships, Honeywell, Inc.

Jan Sharpless, Consultant

Esteban Soriano, The Resources Group

Arnold Sowell, Undersecretary,
State and Consumer Services Agency

James L. Sweeney, Professor of Management
Science and Engineering, Stanford University

Carl J. Weinberg, Weinberg and Associates

Irvin L. (Jack) White, The Winslow Group

The 15 member panel will hold its first meeting in June 2003.

The panel will meet bi-monthly to conduct a comprehensive evaluation of the PIER Program. The evaluation will include a review of the public value,

including but not limited to the monetary and non-monetary benefits of public health and the environment, and the benefit of providing funds for technology development that would otherwise not be funded. Specifically, the Panel will review the status of the PIER Program response to previous Independent Review Panel recommendations, assess the nature of R&D in a state agency, and evaluate long term strategies regarding commercialization and program evolution.

The Panel will submit written findings and recommendations to the Governor and Legislature in a preliminary report, due June 2004, and a final report, due March 2005.

VII. CONCLUSION

The Energy Commission remains fully committed to administering the PIER program in an efficient and effective manner that ensures public input and accountability. The PIER section of the Energy Commission's website is a means of communicating with stakeholders and the public. The website and all reports can be accessed at:

<http://www.energy.ca.gov/pier/>